量子ウォークとネットワークのダイナミクス

Quantum walks and dynamics on networks

日時

2018/01/24 – 01/25

場所

東北大学情報科学研究科 711 室

主催

東北大学 数理科学連携研究センター

支援

数理科学連携研究センター研究費「微分方程式とネットワーク」
（代表者：坂口茂・情報科学研究科）

Program

01/24 (Wed)		
13:00—14:00	R. Portugal	An Optimal Algorithm for the Element Distinctness Problem
14:20—15:20	K. Ozeki	Signature of Edge-colorings in Regular Plane Graphs
15:40—16:40	T. Hasegawa	Phase Transition of Infectious Disease Models in Networks with Finite Seed Fractions
16:50—	Free Discussion, 懇親会	
01/25 (Thu)		
10:00—11:00	N. Konno	TBA
11:20—12:20	M. Seto	Applications of Quasi-orthogonal Integrals to Graph Theory
12:20—14:00	Lunch Break	
14:00—15:00	M. Naruse	Decision Making by Classical and Quantum Light
15:20—16:20	M. Maeda	Dispersive Estimate for Quantum Walks on 1D Lattice
16:30—	Free Discussion	

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Title and Abstracts

Renato Portugal (National Laboratory of Scientific Computing of of the Ministry of Science and Technology, Rio de Janeiro Brazil)

Title : An optimal algorithm for the element distinctness problem

Abstract : The element distinctness problem is the problem of determining whether the elements of a list are distinct. Classically, it requires N queries, where N is the number of elements. In the quantum case, it is possible to solve the problem in $O(N^{2/3})$ queries. We describe a new algorithm [1] with optimal values of two critical time-parameters using the staggered quantum walk. The first critical parameter is the number of repetitions of the algorithm's main block, which inverts the phase of the marked elements and calls a subroutine. The second parameter is the number of quantum walk steps interlaced by oracle queries. We show that, when the optimal values of the parameters are used, the algorithm's success probability is $1-O(N^{1/3})$, quickly approaching to 1.

[1] https://arxiv.org/abs/1711.11336

小関 健太（横浜国立大学）

Kenta Ozeki (Yokohama National University)

Title : Signature of edge-colorings in regular plane graphs

Abstract : To study edge-colorings of graphs,“signature”of an edge-coloring has been extensively considered. In particular, when a graph is planar or projective planar, a signature is closely related to a vertex-coloring in the dual graph (and hence to 4 Color Theorem).
In this talk, I will explain a formal definition of signature and several application, such as Kempe equivalence, list-edge-coloring, and so on.

長谷川 雄央（茨城大学）

Takehisa Hasegawa (Ibaraki University)
Title： Phase transition of infectious disease models in networks with finite seed fractions

Abstract：
Infectious disease models, such as the susceptible-infected-removed (SIR) model and the susceptible-infected-susceptible model, placed in networks have been extensively studied. Many researchers have studied the epidemic threshold, above which a global outbreak can occur, under the assumption that epidemics start from a single infectious node (seed) or an infinitesimal fraction of seeds. On the other hand, few studies have investigated the effects of initial conditions on infectious disease models. In this talk, we discuss what happens in phase transitions when epidemics start from a finite seed fraction.

今野 紀雄（横浜国立大学）

Norio Konno (Yokohama National University)
TBA

瀬戸 道生（防衛大学校）

Michio Seto (National Defense Academy of Japan)

Title： Applications of quasi-orthogonal integrals to graph theory
Abstract : Theory of quasi-orthogonal integrals was developed by de Branges-Rovnyak and Vasyunin-Nikolskii, and is known as an ingredient of de Branges's solution to the Bieberbach conjecture in complex analysis. In this talk, we apply their theory to graph theory and give quadratic inequalities for graph Laplacians.

成瀬 誠（情報通信研究機構）

Makoto Naruse[1,2,3] (National Institute of Information and Communications Technology)

Title：Decision making by classical and quantum light

Abstract：Decision making is a vital function in the age of machine learning and artificial intelligence. We experimentally demonstrate that single photons can be used to make decisions in uncertain, dynamically changing environments. The multi-armed bandit problem was successfully solved using the probabilistic and particle attributes of single photons. Furthermore, by making use of chaotic oscillatory dynamics of semiconductor lasers, ultrafast (1 GHz) decision making has been demonstrated. Moreover, we recently experimentally realized collective decision making by entangled photons to maximize social reward where the issue of Nash equilibrium is physically resolved.
https://sites.google.com/site/photondecisionmaking/
https://sites.google.com/site/makotonaruseweb/
This work is collaborated with
N. Chauvet[2], D. Jegouso[2], A. Drezet[2], B. Boulanger[2], S. Huant[2,3], G. Bachelier[2], A. Uchida[3,4], and H. Hori[3,5]
1: National Institute of Information and Communications Technology, Japan
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3: CREST, JST, Japan
4: Saitama University, Japan
5: University of Yamanashi, Japan

前田 昌也（千葉大学）

Masaya Maeda (Chiba University)

Title： Dispersive estimate for quantum walks on 1D lattice

Abstract ： In this talk, we consider quantum walks on 1D lattice with position dependent coin. We will assume that the coin will converge to some coin in spatial infinity with some specific rate. For the proof, we use the relation between quantum walk and CMV matrix and as a byproduct we will

gain the absence of singular continuous spectrum and embedded eigenvalue, the finiteness of discrete spectrum.
This Talk will be based on the joint work with H. Sasaki (Chiba Univ.), E. Segawa (Tohoku Univ.), A. Suzuki (Shinshu Univ.) and K. Suzuki (Ibaraki Univ.).